

Letter to Editor

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Harmonization of Blockchain Standards: Gaps, Overlaps, and Policy Implications

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Abstract

Blockchain and Distributed Ledger Technology (DLT) have emerged as transformative innovations, reshaping trust, transparency, and data management across various sectors. Despite their rapid adoption—from finance and logistics to healthcare and governance—the lack of globally harmonized standards remains a major obstacle to scalable and secure integration. Multiple international organizations, including ISO, IEEE, ITU, and W3C, are actively developing blockchain-related frameworks. However, these parallel efforts often result in overlaps, inconsistencies, and confusion among stakeholders. Key gaps persist in areas such as cross-platform interoperability, legal compliance (e.g., GDPR), and consensus on terminology. Additionally, technological advancements like zero-knowledge proofs and tokenized ecosystems outpace the ability of traditional bodies to standardize effectively. This article provides a critical overview of the current blockchain standardization landscape, identifying redundancies, deficiencies, and coordination challenges. It concludes with strategic policy recommendations aimed at fostering global cooperation, encouraging modular and adaptive standards, and promoting inclusive multi-stakeholder engagement to support the development of secure and interoperable blockchain ecosystems.

Introduction

Blockchain and Distributed Ledger Technology (DLT) [1] have gained significant traction in recent years due to their potential to revolutionize the way data is recorded, validated, and shared across decentralized networks. Their decentralized architecture removes the need for intermediaries, fostering direct interactions between parties and increasing trust and transparency.

With industries from finance to healthcare exploring blockchain applications, the pace of innovation has accelerated dramatically. However, the lack of standardized global practices presents a major challenge. Interoperability issues, fragmented regulatory landscapes, and inconsistent terminology can create confusion and hinder the widespread adoption of these technologies.

2. Overlaps in Standardization Efforts

At present, multiple international standardization orga-

nizations are involved in developing blockchain-related guidelines. ISO's Technical Committee 307, for instance, is a central player addressing terminology, architecture, privacy, and smart contracts. Meanwhile, organizations such as the IEEE [2] and ITU [3] are simultaneously drafting complementary frameworks.

This multiplicity is both a strength and a complication. While the diversity of perspectives can enrich the development process, it can also lead to overlapping or even contradictory approaches. For example, both the W3C [4] and ISO have created decentralized identity frameworks, but lack of alignment has caused confusion among stakeholders.

3. Gaps in the Current Landscape

Despite considerable progress in areas such as smart contracts and consensus algorithms, several critical gaps persist in the current standardization landscape. One such area is cross-platform interoperability, which remains



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largely unaddressed. Seamless communication and data exchange between disparate blockchain systems is vital for mainstream adoption.

Another area of concern is compliance with global data protection laws. Many emerging blockchain solutions struggle to meet regulations such as the European Union's General Data Protection Regulation (GDPR), primarily due to the immutable and decentralized nature of blockchain networks.

4. Challenges in Achieving International Consensus

Standardizing blockchain technology on a global scale is inherently complex due to several structural and political challenges. National regulations differ significantly in their stance on blockchain, ranging from full endorsement and integration to restrictive bans. This fragmented landscape complicates efforts to develop unified international standards.

Furthermore, the pace at which blockchain technologies evolve presents another challenge. Innovations such as rollups, zero-knowledge proofs, and tokenization models often emerge faster than traditional standard-setting bodies can adapt. By the time a guideline is finalized, it risks being outdated or irrelevant.

5. Recommendations and the Road Ahead

1. Foster collaboration among leading standardization bodies (e.g., ISO, ITU, IEEE, and W3C) by establishing formal communication channels and harmonization initiatives.
2. Establish a UN-led Global Blockchain Standards Observatory to oversee and coordinate international efforts, ensuring consistency and synergy.
3. Utilize regulatory sandboxes and controlled pilot programs to test new blockchain applications in real-world settings under regulatory supervision.
4. Design modular, updatable standards that can evolve with technological advancements, allowing flexibility and rapid adaptation.
5. Promote inclusive public-private partnerships that involve academia, startups, industry leaders, and policy-makers in the standardization process.

6. Conclusion

To realize the full potential of blockchain, the development of coherent and inclusive global standards is essential. These standards will serve as the foundation for future innovations, guiding the integration of blockchain into critical infrastructure and digital services.

A unified framework will also help mitigate security risks, streamline regulatory compliance, and enable seamless interoperability between platforms. As blockchain technology continues to mature, the global community must

work collaboratively to ensure its benefits are equitably distributed and its challenges effectively addressed.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Received: Apr. 2025 Accepted: Apr. 2025

Published online: Apr. 2025

DOI: 10.22034/ASAS.2025.517799.1079

References

- [1] ISO/TC 307. Blockchain and distributed ledger technologies [Internet]. Geneva: International Organization for Standardization; 2023 [cited 2025 Apr 19]. Available from: <https://www.iso.org/committee/6266604.html>
- [2] IEEE Standards Association. Blockchain Standards and Projects [Internet]. Piscataway: IEEE; 2022 [cited 2025 Apr 19]. Available from: <https://standards.ieee.org/initiatives/blockchain/>
- [3] International Telecommunication Union (ITU). Focus Group on Application of Distributed Ledger Technology [Internet]. Geneva: ITU; 2023 [cited 2025 Apr 19]. Available from: <https://www.itu.int/en/ITU-T/focusgroups/dlt>
- [4] World Wide Web Consortium (W3C). Decentralized Identifiers (DIDs) v1.0 [Internet]. 2023 [cited 2025 Apr 19]. Available from: <https://www.w3.org/TR/did-core/>

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